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A European vision for hydrological observations and experimentation

Environmental monitoring and modeling with the support of UAS and satellites

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Water resources and the ecosystems depending on them are under growing pressure due climate change and human activities. Managers and governments need to take effective mitigation and adaptation measures, but decisions are often based on incomplete information as in situ observations are declining, and impacts on ecosystem functioning are not entirely clear. Earth Observation data can help by improving our understanding on the joint regulation of water and carbon fluxes and the links among terrestrial, aquatic and atmospheric processes across whole watersheds and even precipitation-sheds.

Currently, there is a wide range of satellite data streams that can be used in synergy to estimate ecohydrological variables, but this requires a redesign of methods. Additionally, remote sensing in the optical domain is mostly used to estimate structural characteristics of vegetation such as biomass, greenness or leaf area index, while estimation of rapidly changing ecophysiological variables, such as stomatal conductance, transpiration or photosynthesis, the distinction between metabolic pathways (C3 or C4) or water use strategies (iso/anisohydric) is still a challenge.

Drones or UAS can provide information complementary to satellites by acquiring in (quasi) real time environmental variables under clouds. They can bridge the scale mismatch with in situ datasets, augment them, and allow monitoring of small farms or narrow headwater streams among others. An emerging technology are hyperspectral miniaturized sensors on drones but the data quality is affected by lower signal to noise ratios compared to airborne sensors, flying under intermittent clouds and turbulences, and in several cases a lack of thorough radiometric and spectral calibrations.

At the conference, I will present some examples of research that jointly exploit hyper/multispectral and thermal data with proximal, drones, or satellite sensors to estimate ecohydrological variables and evaluate interventions using data-driven or process based models. For example, how biochar affects water use efficiency of rice, understanding better leave thermoregulation under heatwaves or drought or develop indicators of the ecological state of freshwater systems. In addition, some of the current limitations and future perspectives of this technology will be discussed.